User's Manual

LC5296/5006-RN/LC5296H Temperature Controller

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Note:

Information in this manual is subject to change without prior notice or permission.

Warning Symbol

The symbol calls attention to the operating procedure, practice or the like which if not correctly performed or adhered to , could result in personal injury or damage to or destruction of part or all of the product and system. Do not proceed beyond a warning symbol until the indicated condition are fully understood and met.

Class-2 Type of instrument

Note: Class-2 – Instrument is using Line & Neutral for Power Supply Input.

1.0 TEMPERATURE CONTROLLER OVERVIEW

Model LC5296/5006-RN is a microcontroller based On/Off Temperature controller, incorporate bright, 4 Digit Seven Segment Display indicating process value and set value.

ON/OFF Controller is the simplest form of temperature control device. The output from the device is either on or off, with no middle state. An on-off controller will switch the output only when the temperature crosses the setpoint. For heating control, the output is on when the temperature is below the set point, and off above set point.

Since the temperature crosses the set point to change the output stage, the process temperature will be cycling continually, going from below set point to above, and back below. In cases where this cycling occurs rapidly, and to prevent damage to contactors and valves, an on-off differential, or “hysterisys,” is added to the controller operations. This hysterisys assures, if temperature exceed set point by a certain amount before then only output will turn off or on again. On-Off hysterisys prevents the output from “chattering” or making fast, continual switches if the cycling above and below the set point occurs very rapidly.

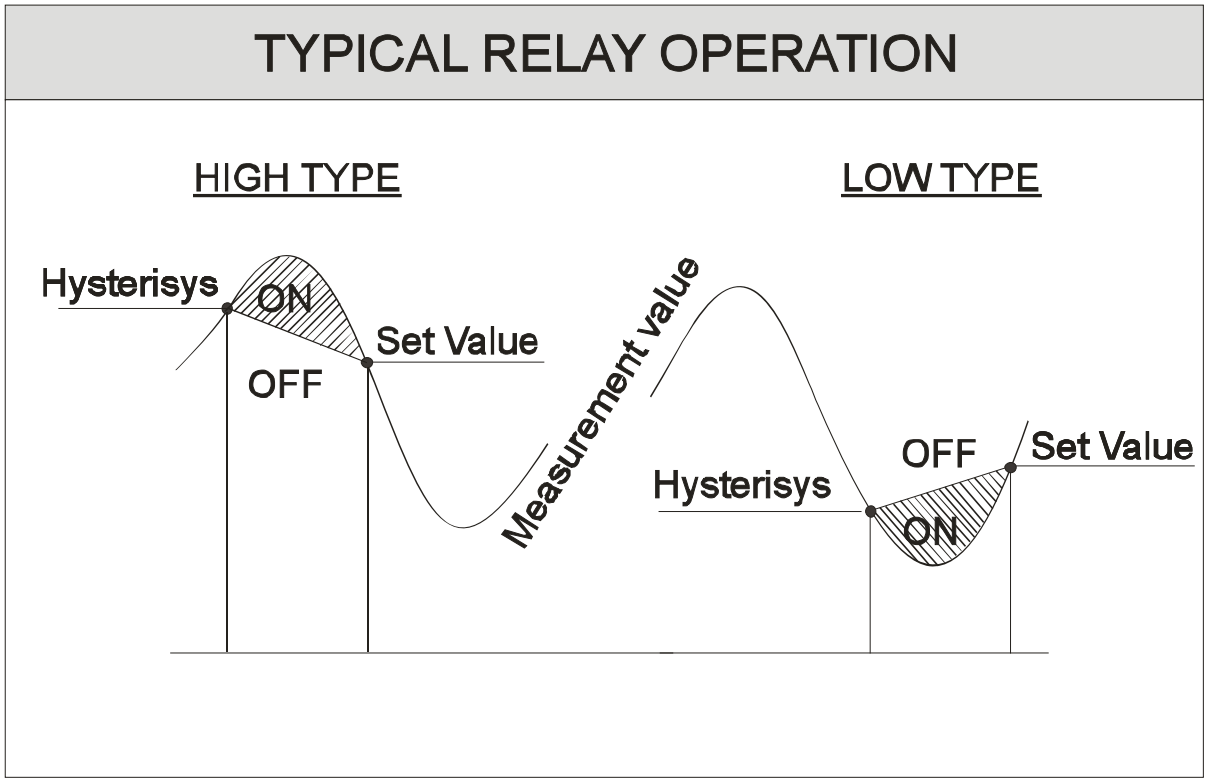


Figure 1: Typical Relay operation

High type:

For High type of set value, once process value reaches up to set point + Hysterisys value, relay will be ON and it will be ON until process value goes down to Set point.

Low type:

For Low type of set value, once process value reaches down to set point + Hysterisys value relay will be ON and it will be ON until process value goes up toward Set point.

On/Off control is usually used where a precise control is not necessary, in systems which cannot handle having the energy turned on and off frequently, where the mass of the system is so great that temperature change extremely slowly.

2.0 SPECIFICATIONS

2.1 DISPLAYS:

LC5296:

- 4 digits 0.56" Seven Segment Red LED's for Process Variable in °C.
- 4 digits 0.40" Seven Segment Green LED's for Status Variable in °C.
- Individual discrete Red LED's to indicate relay status and communication (Rx and Tx).

5006-RN:

- 4 digits 0.56" Seven Segment Red LED's for Process Variable in °C.
- Individual discrete Red LED's to indicate relay status and communication (Rx and Tx).

LC5296H:

- 4 digits 0.56" Seven Segment Red LED's for Process Variable in °C.
- Individual discrete Red LED's to indicate relay status and communication (Rx and Tx).

2.2 INPUTS:

- RTD - PT100 3-wire (Automatic 3 wire compensation)
- RTD – PT100(0.1°C).
- Thermo-couple types J, K, T, R, S (ANSI standard) (Cold junction compensation)
- 4-20mA/1-5 V dc linear
- 0-20mA/0-5 V dc linear
- Burn out Current : 0.25 uA
- CMRR : > 120dB
- NMRR : > 40dB
- Input Impedance : > 1MΩ

2.3 INPUT RANGE:

PT100	:	-200 to 850 °C
PT100 (0.1°C)	:	-199.9 to 850.0 °C
J	:	-200 to 1200°C
K	:	-200 to 1372°C
T	:	-100 to 400°C
R	:	0 to 1768°C
S	:	0 to 1768°C

4-20mA/1-5VDC, 0-20mA/0-5VDC:
-1999 to 9999 (Field Scalable)

2.4 ACCURACY:

- ***** +/- (0.25% of Full Scale + 1 degree) for T/C and RTD input.
- ***** +/- (0.25% of Full Scale + 1 count) for Linear input.
  - Subject to recalibration for i/p change.

2.5 OUTPUT:

- **Relay O/P:**
  Rating: 2A/230VAC

- **Re-transmission 1:**
  Type: 4-20 mA, 0-20 mA
  Load: 500 Ohms Max
  Type: 0-5 V DC, 1-5 V DC, 0-10 V DC
  Load: 2K minimum
  Isolation: 500VDC
  Accuracy: ±0.25% of Full scale

- **Re-transmission - 2:**
  Type: 4-20 mA, 0-20 mA
  Load: 500 Ohms Max
  Type: 0-5V DC, 1-5V DC, 0-10V DC,
  Load: 2K minimum
  Isolation: 500VDC
  Accuracy: ±0.25% of Full scale

- **Transmitted Power Supply:**
  24VDC @ 30mA (±10% Accuracy)

- **Isolated RS485 Communication:**
  Protocol: Modbus RTU
  Parity: None
  Baud Rate: 9600, 19.2k, 38.4k.
  Isolation: 500VDC

2.6 CALIBRATION:

- Zero and Span calibration using front key pad.
- Auto zero calibration in thermocouple (T/C) type input.
- CJC (Cold Junction Compensation) for T/C type input And Software 3-wire lead Compensation for RTD sensor.
- Instrument Warm-up Time < 30 Min.

2.7 TYPES OF SET POINT:

- Set point types are configurable to energize relays for actual value below or above set point with delay time for individual Relay.
- Hysteresis setting 1 to 100 Counts.

2.8 POWER SUPPLY:

- **Operating Supply:**
  85-265VAC @ 50Hz
  18-36VDC (Optional)
- **Power consumption:**
  < 10 VA

2.9 ENVIRONMENTAL CONDITION:

- **Insulation Resistance:**
  >50MΩ @ 500VDC

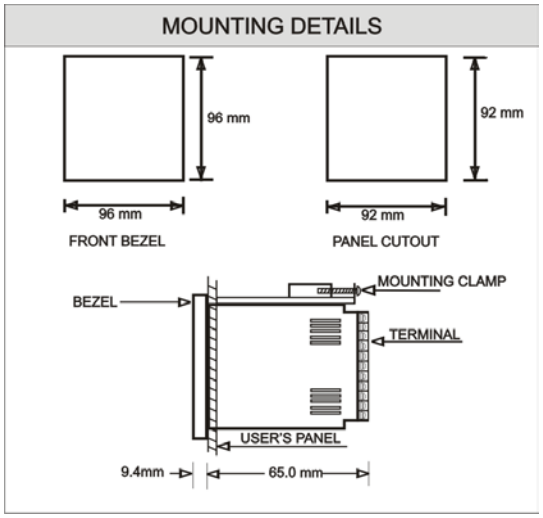
- **Isolation Specifications:**

Measured Input terminal: Isolated from other Output terminals & Not isolated from the internal circuit.
24V DC Supply[TPS]: Isolated from other output terminals & Not isolated from the internal circuit & input.
Retransmission output terminal: Isolated from input terminals & communication terminal.
RS-485 communication terminal: Isolated from Input terminals & isolated from the Other Output terminal.
Relay Contact o/p terminal: Isolated from input terminals, internal circuit and other output terminals.
Retransmission output1 & Retransmission output1 terminal: Non Isolate from each other and Isolated from Input Terminals.
Power supply terminal: Isolated from other input and Output terminals and internal circuit.

- **Molding type:** ABS Plastic
- **Weight**: **300 Gms Appx.**
- **Ambient Temperature:**
  0 to 55 °C
- **Humidity:**
  20 to 95% RH non-condensing
- **Storage Temperature:**
  0-80 °C

3.0 MOUNTING DETAILS

LC5296/5006-RN:



LC5296H:

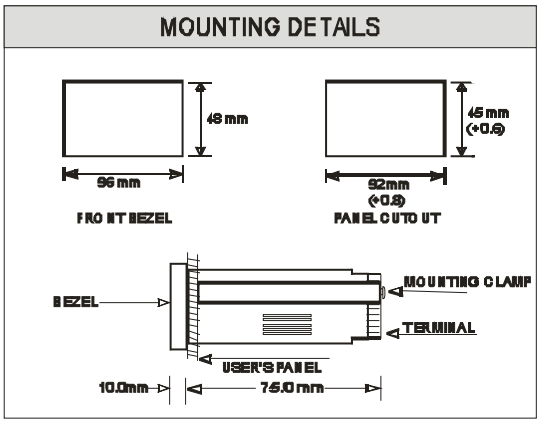


Figure 2: Mounting Detail

LC5296/5006-RN:

- **FRONT BEZEL:** 96 x 96 mm
- **PANEL CUTOUT:**
  92mm (+0.8) x 92mm(+0.8)
- **DEPTH BEHIND THE PENAL:**
  65.0mm

LC5296H:

- **FRONT BEZEL:** 48 x 96 mm
- **PANEL CUTOUT:**
  45 (+0.6)mm x 92 (+0.8)mm
- **DEPTH BEHIND THE PENAL:**
  75.0mm with Terminal

Note:

UNPACKING: Upon receipt of the shipment remove the unit form the carton and inspect the unit for

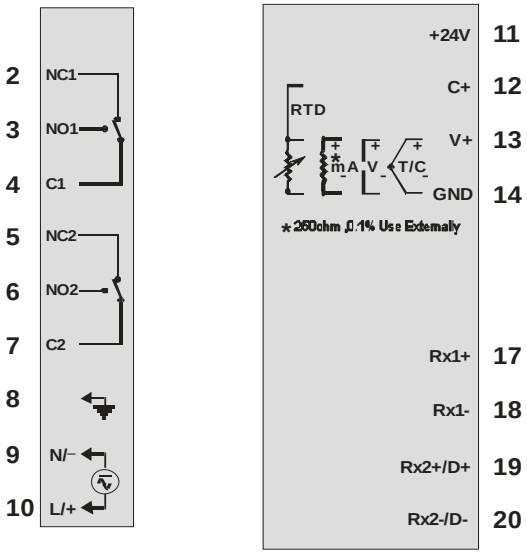
shipping damage. If any damage due to transit, report and claim with the carrier. Write down the model number, serial number, and date code for future reference, when communicating with our *Customer Support Division.*

Use external switch or circuit breaker and external over current protection devices to protect whole panel or instrument in hazardous condition.

Do not use this instrument in areas such as excessive shock, vibration, dirt, moisture, corrosive gases or rain. The ambient temperature of the areas should not exceed the maximum rating specified.

4.0 TERMINAL CONNECTIONS

LC5296/5006-RN:



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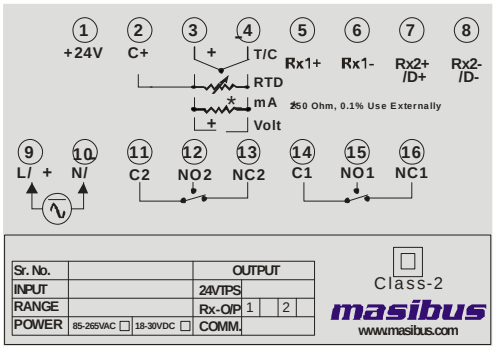


Figure 3: Terminal connection

LC5296/5006-RN:

1. Terminal 2 & 3 & 4:
For Relay-1 potential free Contacts (Use 230V -2A load)

2. Terminal 5 & 6 & 7:
For Relay-2 potential free Contacts (Use 230V -2A load)

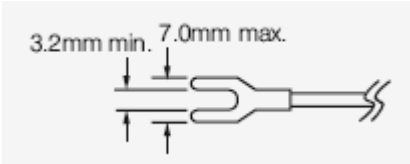


Figure 4: Lead Termination

3. Terminal 9 & 10:
Power Supply Input (85-265VAC @ 50Hz / 120-290VDC).
24VDC (Optional)

4. Terminal 11:
+24V Transmitted power supply Output.

5. Terminal12:
For RTD Input Only (Three wire Compensation – c^+ terminal).

6. Terminal 13 & 14:
For T/C & Linear Input

7. Terminal 17 & 18:
For retransmission no. 1 output

8. Terminal 19 & 20:
For retransmission no. 2 output or
Communication.

LC5296H:

1. Terminal 14 & 15 & 16:

For Relay-1 potential free Contacts (Use 230V -2A load)

2. **Terminal 11 & 12 & 13:**
   For Relay-2 potential free Contacts (Use 230V -2A load)
3. **Terminal 9 & 10:**
   Power Supply Input (85-265VAC @ 50Hz / 120-290VDC).
   24VDC (Optional)
4. **Terminal 1:**
   +24V Transmitted power supply Output.
5. **Terminal 2:**
   For RTD Input Only (Three wire Compensation – c^+ terminal).
6. **Terminal 3 & 4:**
   For T/C & Linear Input
7. **Terminal 5 & 6:**
   For retransmission no. 1 output
8. **Terminal 7 & 8:**
   For retransmission no. 2 output or
   Communication.

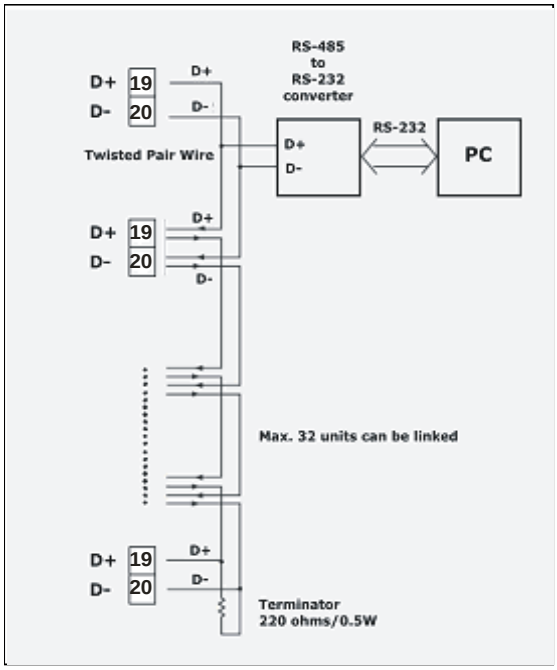


Figure 5: RS-485 Communication Detail

Note:

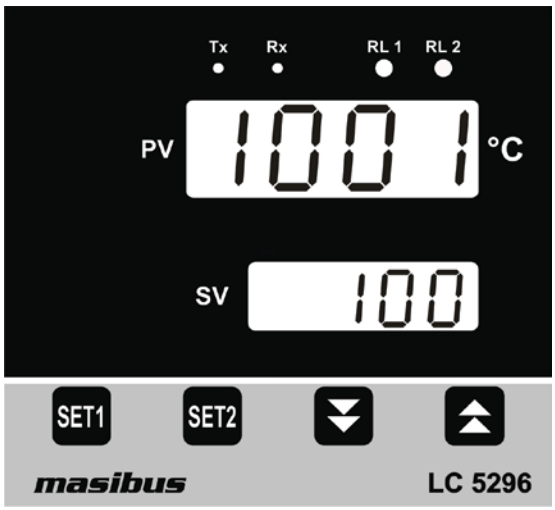
1. Use Repeater after each and every set of 32 instruments.
2. Do not connect 3rd terminal (C+) when linear or TC input is selected.
3. Switch off the power before wiring.
4. Supply voltage must be below maximum voltage rating specified on the label.
5. All wiring must confirm to appropriate standards of good practice and local codes and regulations. Wiring must be suitable for Voltage, Current and temperature rating of the system.
6. Unused control terminals should not be used as jumper points as they may be internally connected, which may cause damage to the unit.

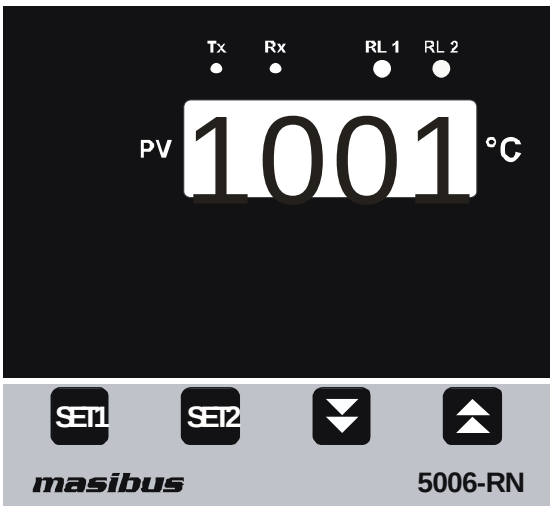
Note:

1) Use >250V-1Amp Cable for Power Supply.
2) If cable has two parallel wires inside then isolation between them must be 2.5 KV.

5.0 FRONT PANEL DESCRIPTION

LC5296/5006-RN:





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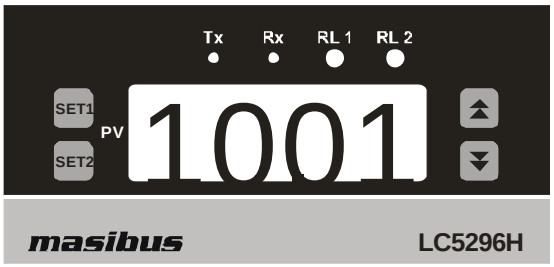

Figure 6: Details of Front Panel

1. Increment Key:
- Increment value in PV window.

2. Decrement Key:
-Shows ambient value for T/C Input in run mode.
- Decrements value in PV window.

3. SET-1 key:
On pressing this key set value-1 is displayed in PV window.

4. SET-2 key:
On pressing this key set value-2 is displayed in PV window.

5. PV window:
- 4 digital 0.56 inch RED Display.

6. SV window:
- 4 digital 0.28 inch GREEN Display.

7. Relay-1 Indication:
- ON when relay-1 is energized.

8. Relay-2 Indication:
- ON when relay-2 is energized.

9. Set Value-1 Indication:
- ON when set-1 is saved in Disp menu of Conf mode.

10. Set Value-2 Indication:
- ON when set-2 is saved in Disp menu of Conf mode.

6.0 CONFIGURATION MODE

Press ▲+▼ Key together to enter configuration mode after entering correct password.

Note: When user Press ▲/▼, the Parameters will change in SV window for LC5296 Model.

6.1 PASSWORD

Display	**PASS**
Press ▲/▼	**1**
Press SET1	**ConF**

Once correct password is entered, Configure mode is displayed.

6.2 CONFIGURE INPUT TYPE

Display	**ConF**
Press SET1	**InPt**
Press ▲/▼	**tC K**
Press SET1	**InPt.**

Press SET1 to configure ZERO,

6.3 CONFIGURE ZERO

Display	**zero**
Press ▲/▼	**-100**
Press SET1	**zero.**

Press SET1 to configure SPAN

6.4 CONFIGURE SPAN

Display	**spaN**
Press ▲/▼	**1200**
Press SET1	**spaN.**

Press SET1 to configure SET POINT1

6.5 CONFIGURE SET POINT 1

Display TSP1

Press ⇧/⇩ L on

Press SET1 TSP1.

Press SET1 to configure SET POINT2,

6.6 CONFIGURE SET POINT 2

Display tSP2

Press ⇧/⇩ H on

Press SET1 TSP2.

Press SET1 to configure OPEN SENSOR,

6.7 CONFIGURE OPEN SENSOR

Display oPES

Press ⇧/⇩ UP

Press SET1 oPES.

Press SET1 to configure DISPLAY SET POINT,

Up scale: Under Open condition PV is treated above set point.

Down scale: Under Open Condition PV is treated below set point.

6.8 CONFIGURE DP

Note: This option is available only when the selected input type is linear (0-5V or 1-5V), else it's not displayed.

Display dP

Press ⇧/⇩ 1

Press SET1 dP.

Press SET1 to configure Display set Point,

6.9 CONFIGURE DISPLAY SET POINT

Display dIsp

Press ⇧/⇩ St-1

Press SET1 dIsp.

Press SET1 to configure Brightness,

6.10 CONFIGURE BRIGHTNESS

Display brht

Press ⇧/⇩ 50

Press SET1 brht.

Press SET1 to configure Serial Number

- **For Communication Feature, following Parameters are there in configuration mode.**

6.11 CONFIGURE SERIAL NUMBER

Display SrNO

Press ⇧/⇩ 1

Press SET1 SrNO.

Press SET1 to configure Baud Rate,

6.12 CONFIGURE BAUD RATE

Display bAUd

Press ⇧/⇩ 9600

Press SET1 bAUd.

Press SET1 to configure Delay time for Relay1,

6.13 CONFIGURE RELAY1 DELAY TIME

Display rd1

Press ⇧/⇩ 5

Press SET1 rd1.

Press SET1 to configure Delay time for Relay2,

6.14 CONFIGURE RELAY2 DELAY TIME

Display Rd2

Press ▲/▼ 5

Press SET1 rd2.

Press SET1 to configure Retransmission - 1 type volt.

6.15 CONFIGURE RETRANSMISSION-1 TYPE

Display rt 1

Press ▲/▼ 0-10

Press SET1 rt 1.

Press SET1 to configure RETRANSMISSION-2 TYPE CURRENT

Note: If retransmission current type is selected then retransmission voltage type cannot be selected, at a time only one will work while the other will lock.

- **Retransmission2/Communication is optional. Either of them will be available. For retransmission2 Feature, following Parameters are available in configuration mode.**

6.16 CONFIGURE RETRANSMISSION-2 TYPE

Display rt 2

Press ▲/▼ 4-20

Press SET1 rt 2.

Press SET1 to configure Hysterisis-1

6.17 TO SET VALUE OF HYSTERISIS 1

Display HY-1

Press SET1 + ▲/▼ 1

Press SET1 HY-1.

Press SET1 to configure Hysterisis-2

6.18 TO SET VALUE OF HYSTERISIS 2

Display HY-2

Press SET1 + ▲/▼ 2

Press SET1 HY-2.

Press SET1 to configure Pass word

6.19 CONFIGURE CHANGE PASSWORD

Display Pass

Press ▲/▼ 0

Press SET1 Pass.

Press SET1 to configure Conf. mode

6.20 VERSION NO

Display VErS

Display on SV window 01.00

Press SET1 VErS.

Press SET1 COnF.

Press ▲+▼ Key together to come out of configuration mode or in Run Mode. Now Instrument is in Run Mode.

7.0 RUN MODE

In Run mode, press SET1 for configure Setpoint-1 **and** Press SET2 for configure Setpoint-2.

7.1 TO SET VALUE OF SET POINT1

Display **St-1**

Press SET1 + ▲/▼ **100**

To change Set Point1 Value.

7.2 TO SET VALUE OF SET POINT2

Display **St-2**

Press SET2 + ▲/▼ **100**

To change Set Point2 Value

7.3 TO SEE AMBIENT

Press ▼ **30.0**

To Check Ambient Value in Run mode.

8.0 CALIBRATION MODE

Press ▲+▼ Key together to enter configuration mode after entering correct password.

Display **PASS**

Press ▲/▼ **1**

Press SET1 **ConF**

Press ▲ **CAL**

Press SET1 enter calibration mode.

8.1 CALIBRATION OF AMBIENT

Display **AMb**

Press ▲/▼ **23.8**

Press SET1 **AMb.**

(Adjust req. Amb. value)

Press SET1 to calibrate Zero,

8.2 CALIBRATION OF ZERO

If thermocouple input type, then calibration of zero will not be displayed.

Display **CALZ**

Press ▲/▼ **-099**

Press SET1 **CALZ.**

Press SET1 to calibrate Span.

8.3 CALIBRATION OF SPAN

Display **CALS**

Press ▲/▼ **1099**

Press SET1 **CALS.**

Press SET1 to calibrate RETRANSMISSION-1 ZERO.

Steps to calibrate Retransmission o/p: -

while calibrating the retransmission output, input is not required. When entered in rx-zero calibration submenu, respective zero output will be transmitted. To calibrate the rx-zero, simply increment or decrement the counts until correct value obtained.

Example:
If Rx o/p type:- 4-20mA
Rx-zero calib o/p:- 4.12mA
Now, press decrement until the o/p value Becomes 4.00mA. At this point, number of counts decremented will be displayed on SV window. Follow similar steps to calibrate Rx. Span.

8.4 CALIBRATION OF RETRANSMISSION-1 ZERO

Display **rtZ1**

Press ▲/▼ **0**

Press SET1 **rtZ1.**

Press SET1 to calibrate RETRANSMISSION-1 SPAN.

8.5 CALIBRATION OF RETRANSMISSION-1 SPAN

Display **rtS1**

Press ▲/▼ **0**

Press SET1 **rtS1.**

Press SET1 to calibrate RETRANSMISSION-2 ZERO.

8.6 CALIBRATION OF RETRANSMISSION-2 ZERO

Display **rtZ2**

Press ▲/▼ **0**

Press SET1 **rtZ2.**

Press SET1 to calibrate RETRANSMISSION-2 SPAN,

8.7 CALIBRATION OF RETRANSMISSION-2 SPAN

Display **rtS2**

Press ▲/▼ **0**

Press SET1 **rtS2.**

Press SET1 to configure Cal mode .

Display **Cal**

Press ▲+▼ Key together to come out of calibration mode to Run Mode.

Note: Amb calibration is only available with J,K,R,T,S - T/C input.

9.0 Applications Of LC5296 Temperature Controller:

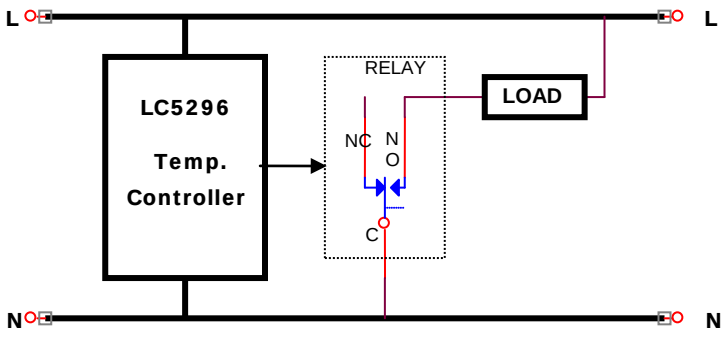

Figure 7: Direct Load Connected with Line

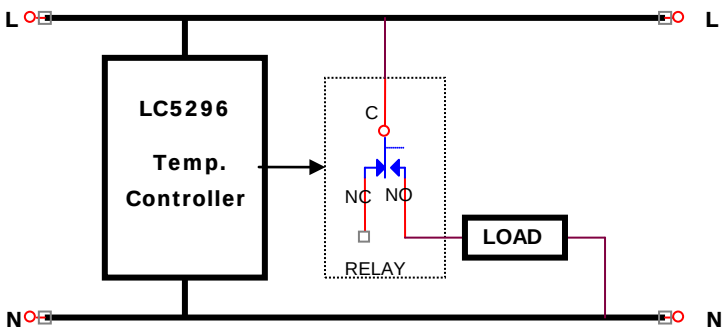

Figure 8: Direct Load Connected with Neutral

Note:

1. **Relay has three potential free terminals C, NC & NO. User can use according to application either C to Line or Neutral.**
2. **The application Figure is for reference only.**

10 COMMUNICATION PROTOCOL – MODBUS-RTU DETAILS:

INTRODUCTION

The unit can be connected in RS-485 communication data link either in multi drop or repeat mode. Each unit must have unique Serial Number. Entire range of addresses (1 to 247) may be used. Before starting any communication, choose a baud rate compatible to the host computer. The serial protocol used is MODBUS RTU.

Protocol details:

The function codes used Read Write of parameters are:

03. – READ HOLDING REGISTERS (REFERENCE - 4x).For Read operation
06. – PRESET SINGLE REGISTER (REFERENCE - 4x).For Write operation

The error checking field contains a 16-bit value implemented as two eight-bit bytes. The error check value is the result of a Cyclical Redundancy Check (CRC) calculation performed on the message contents.

Modbus RTU protocol addresses for RS 485 Communication

Sr. No.	Analog Parameters	Absolute Address	Type	Access Type	Model LC5296	Model LC5296H /5006-RN
1	PROCESS VALUE	30001	Int	Read Only	√	√
1	Input Type	40001	Int	Read/Write	√	√
2	Zero	40002	Int	Read/Write	√	√
3	Span	40003	Int	Read/Write	√	√
4	SET Type-1	40004	Int	Read/Write	√	√
5	SET Type-2	40005	Int	Read/Write	√	√
6	Open Sensor Status	40006	Int	Read/Write	√	√
7	Decimal Point	40007	Int	Read/Write	√	√
8	Display set point	40008	Int	Read/Write	√	NA
9	Brightness	40009	Int	Read/Write	√	√
10	Serial Number	40010	Int	Read/Write	√	√
11	Baud Rate	40011	Int	Read/Write	√	√
12	Relay Delay -1	40012	Int	Read/Write	√	√
13	Relay Delay -2	40013	Int	Read/Write	√	√
14	Retransmission o/p Type -1	40014	Int	Read/Write	√	√
15	Retransmission o/p	40015		NA	NA	NA

	Type -2					
16	**Hysterisis 1**	**40016**	**Int**	**Read/Write**	√	√
17	**Hysterisis 2**	**40017**	**Int**	**Read/Write**	√	√
18	**Pass word**	**40018**	**Int**	**Read/Write**	√	√
19	**Set Value 1**	**40019**	**Int**	**Read/Write**	√	√
20	**Set Value 2**	**40020**	**Int**	**Read/Write**	√	√

Note: NA = Not Applicable.

Note:

1) The possible values to be entered through modbus for above parameter's in Table are as follows:

a) Input Type (Applicable values : 0 to 9):

Input Type	Value
J-tc	0
T-tc	1
K-tc	2
R-tc	3
S-tc	4
Rtd	5
Rtd.1	6
0 – 5V	7
1 – 5V	8

b) Set point Type -1 / Set point Type -2 :

Type	Value
L-on	0
h-on	1

c) SET VALUE-1 HYSTERESIS / SET VALUE-2 HYSTERESIS: (Applicable Values: 0 to 100)

d) Open Sensor Status:

Type	Value
DN(down)	0
UP	1

e) Decimal Position :

Input Type	Maximum Value
Rtd	0
Rtd.1	0
J-tc	0
K-tc	0
T-tc	0
R-tc	0

S-tc	0
1 – 5v	3
0 – 5v	3

f) Display Set Point:

Type	Value
Set point - 1	0
Set point - 2	1

g) Brightness : (Applicable Values : 0 to 100)

h) Serial Number : (Applicable Values : 0 to 255)

i) Baud Rate :

Type (bps)	Value
9600	0
19200	1
38400	2

j) Relay Delay-1/ Relay Delay-2: (Applicable Values : 0 to 99)

k) Retransmission o/p Type -1/2: (Applicable Values : 0 to 99)

Type (bps)	Value
0-10V	0
0-5V	1
1-5V	2
4-20mA	3
0-20mA	4

l) Pass word: (Applicable Values : 0 to 99)

m) Hysterisis 1/2: (Applicable Values : 0 to 100)

n) Set Value 1: (Applicable Values : >Zero & <Span)

9.4: EXCEPTION RESPONCE:

CODE	MEANING
01	Function code Invalid. It must be 01, 05, 03 or 06.The function code received in the query is not allowable action for the slave.
02	Illegal address value. The data address received in the query is not an allowable address for the salve.
03	Illegal data value. A value contained in the query data field is not an allowable value for the salve.

Table 4: Exceptional Response

10.0 Parameter Description:

Mode of Operation	Description	Message	Description
Conf	**Configuration Mode**	**inp**	**Input Type**
		J tc	**J type T/C Input**
		T tc	**T type T/C Input**
		K tc	**K type T/C Input**
		R tc	**R type T/C Input**
		S tc	**S type T/C Input**
		rtd	**RTD Input (1%)**
		Rtd.1	**RTD Input (0.1%)**
		0-5V	**0 -5V Linear Input**
		1-5V	**1 -5V Linear Input**
		Zero	**Zero setting for input**
		Span	**Span setting for input**
		Tsp1 or **tsp2**	**Type of setpoint**
		l-on	**High type setpoint**
		h-on	**Low type setpoint**
		Dp	**Decimal Point**
		Opes	**Open sensor**
		dISP	
		brht	
		Srno	**Serial number**
		Baud	**Baud rate**
		Rd1	**Relay1 Delay Time**
		Rd2	**Relay2 Delay Time**
		Rt 1	**Types of Rx O/P 1**
		Hy-1	**HYSTERESIS 1**
		Hy-2	**HYSTERESIS 2**
		PASS	**PASSWORD**
		vErS	**S/W version No.**
Cal	**Calibration Mode**	**AMb**	**Calibration of Ambiant**
		CALZ	**Calibration of Zero Value**
		CALS	**Calibration of Span Value**
		Rtz1	**Calibration of**

			Retransmission Output Zero1 Value
		Rts1	**Calibration of Retransmission Output Sapn 1Value**
		Rtz2	**Calibration of Retransmission Output Zero2 Value**
		Rts2	**Calibration of Retransmission Output Sapn 2Value**
Process Value on PV Window.	**Run mode**	**Open***	**Open Sensor indication**
		Derr*	**Data Error**

11 Maintenance:

Dangerous voltages capable of causing death are sometimes present in this instrument. Before installation or beginning of any troubleshooting procedures the power to all equipment must be switched off and isolated. Units suspected of being faulty must be disconnected and removed first and brought to a properly equipped workshop for testing and repair. Component replacement and interval adjustments must be made by a company person only.